9. The internationalization of Scientific Research in China

賴　　平　耀
Lai Pingyao

中国科学院世界経済与政治研究所
The Institute of World Economics & Politics, The Chinese Academy of Social Sciences

1. Introduction

The purpose of this talk is to make an assessment of important trends of internationalization in China's scientific research field during the reform period, and to identify the main factors behind these important changes. We try to present a coherent picture of how the process of internationalization of scientific research in China evolves, pushed by the basic forces of both opening to the outside world and economic reform, and further to indicate the future direction of change.

The first part of the talk reviews the main trends of internationalization in China's scientific research sector since 1978. We analyze how reform and opening to the outside world have deeply changed the landscape of China's scientific research sector. While the process is far from complete, some patterns emerged which are important in their own right and indicate future direction of reform and development. Our analysis focuses on the following areas: the increase of international cooperation and exchange, and diffusion of international standards and practices, knowledge, and information from developed countries.

The second part of the talk examines the main factors behind these important changes. We identify several important factors, including the opening policy, economic reform and accompanying development of market economy, increasing participation in international exchanges, development of information technology and its rapid diffusion in China. Before concluding, we briefly assess some important issues that are of serious policy implications.

2. Main trends

Internationalization can be defined in terms of two perspectives. First, it can refer to free movement of people, goods, etc. across national borders. Second, it can refer to convergence of different economies, cultures, etc. towards to the same steady state. In the present context we understand the internationalization in the both senses. Certainly the two are interrelated. Free movement promotes convergence, and convergent process facilitates free movement.

The process of the internationalization of scientific research in China began when Chinese government introduced the policy of reform and opening to the outside world in 1978. Since

then many important changes have taken place. While the whole process is quite complicated, some clear-cut directions have emerged, which will have far-reaching impact on the future development of China's scientific research and higher education. Below, we briefly examine some major developments, with a particular reference to the field of economics.

International exchange One of the most important aspects of internationalization in the academic field is international exchange in persons. Since 1978 China gradually restored academic contacts with the West. This takes several forms. First, China began to send students to the western universities to study for advanced degrees, and at the same time, the authority allowed students to apply directly to the western universities for higher-degree study. In the former case, the funding is either completely provided by the Chinese government, or jointly by the Chinese government and foreign official institutions or private sources (e.g.). In the latter case, the funding originally almost completely comes from the foreign universities. However, as the income level of urban residents steadily increases in the subsequent rapid economic development, more and more Chinese students choose to study abroad through self-paying tuition fees. From 1978 until the present, the cumulative number of students and scholars studying abroad reaches nearly 600,000. The geographical distribution covers over one hundred countries/regions. Among 430,000 students and scholars who remain abroad, about 270,000 are studying in universities for degrees.

Table 2.1. The Number of Students Studying Abroad

Year	Students sent by government/units	Students self-paying tuition fees
1978	860	
1980	2,124	
1985	4,888	
1990	2,950	
1996	2,110/5,400	13,600
2000	2,808/3,888	32,293
2002	3,500/4,500	117,000

From the above table, we can clearly identify several important changes. First, the number of students studying abroad grows rapidly. Second, the students who self-pay tuition fees far-outnumber the students sent by government. Besides we may also notice of the following facts. First, students studying abroad are mainly concentrated in the West (U.S., Canada, E.U., and Australia). Second, they are further concentrated in English-speaking countries. Beginning in the second half of the 1990s, the number of students going to Britain and other European countries witnessed a sharp increase. This is caused by the following factors. First, the visa

approval supply of US lags behind the demand. Second, the scholarship offers stagnated. Third, the expenses of studying in US are in general higher than that in European countries.

Another important international exchange involves exchanges between scholars. In the initial period of time, regular government/foreign foundation-sponsored exchange programs played an important role. Among foreign foundations, some American and German foundations have been active throughout. As the reform and opening proceeds, more and more individual academic institutions and scholars developed close academic contacts with foreign counterparts with broad sources of funding.

In the field of international exchange and cooperation the Chinese academy of Sciences, the Chinese Academy of Social Sciences, and several top universities play a leading role. From 1978 until the present the international exchange of these institutions increased over tenfold. Take Qinghua University as an example. Up to now, Qinghua University has established exchange agreements with 120 universities in 26 countries and regions. The cumulative number of teachers and students sent by the university reaches 16,000, and the cumulative number of foreign students exceeded 2500. For now, the number of foreign students studying in famous Chinese universities is still small compared to prestigious American and British universities, but it is rapidly increasing.

Table 2.2. The International Exchange of the Chinese Academy of Sciences

Year	Scholars sent by the Academy	Visiting Scholars to the Academy
1978	587	571
1980	950	1760
1985	1713	3197
1990	4456	2184
1996	5432	2018
2000	6622	2929
2001	7304	8576

Table 2.3. The International Exchange of the Chinese Academy of Social Sciences

Year	Scholars sent by the Academy	Visiting Scholars to the Academy
1978	21	49
1980	212	373
1985	489	561
1990	525	571
1996	1116	1185
2000	1279	2843
2001	1278	2658

Higher education When China introduced reform and opening-up policy in 1978, China had neither doctorate training program nor post-doctorate system. As China restored policy of sending students studying abroad for advanced degree, and allowed students to directly apply to western universities for the advanced study, there gradually emerged a demand for the domestic doctorate-training program. The first experimental program was introduced in 1979. In a late time, the post-doctorate system was also introduced, according to the proposal by an American-Chinese physicist, Nobel Prize laureate Li Zhendao. The initial pace was slow. Throughout the 1980s, the total number of doctor degree receivers was less than 2000. The diffusion was accelerated in the 1990s. By 2001, the total number reached 12,465. The program covered all major branches of natural sciences, engineering, social sciences, as well as humanities. During the same period of time, the post-doctorate system was also gradually popularized. By the late-1990s, almost all top research institutions as well as universities established formal post-doctorate system.

Table 2.4. Doctor Degree Receivers: 1978–2001

Year	Total number	Sciences	Engineering	Economics
1982	13			
1985	234			
1988	1682	201	258	51
1991	2556	510	704	86
1993	2114	584	756	101
2001	12465	2655	434	621

Another important development of the internationalization in higher education is associated with the reform in undergraduate as well as graduate curriculum, especially in social sciences. Before 1978, China's higher education had been in complete isolation with the West. In the initial period of reform and opening to the outside world, western social sciences were allowed to enter undergraduate as well as graduate curriculum. However, these courses were treated as a subordinate part. Beginning in the 1990s, substantial progress has been made. In the economics field, the name of "western economics" is replaced by "ordinary economics", "modern economics". In some top universities, the course composition closely followed the development in American universities. Some concrete examples may help to illustrate the width and depth of the change. First, in the late 1970s and the early 1980s, mathematics was only a small part of economics curricular, and economics courses used few advanced mathematics. The two were basically separated. Now, calculus, linear algebra, probability and mathematical statistics become standard toolbox even for undergraduate economics students, and they are much more integrated into economics courses. Some new fields also enter undergraduate courses, such as game theory. Second, graduate courses also followed the standard in American universities by introducing separate advanced courses, such as advanced macroeconomics, advanced microeconomics, and advanced econometrics. Third, throughout the 1980s, teaching of the "western economics" mainly relied on textbooks written by Chinese economists who were not trained in the west. Beginning in the second half of the 1990s, there emerged a wave of directly introducing popular English textbooks in a systematic way. The series edited by the Press of the Chinese People's University was a prominent example. The initial efforts were concentrated on translation. This has an obvious shortcoming, that is, it is difficult to find a sufficient number of qualified translators. Then, several presses went to the direct introduction of English versions. Up to now, several prestigious presses - Beijing University Press, Qinghua University Press, Shanghai University of Economics and Finance Press have engaged this enterprise, responsible to the editing and publication of tens of series of popular English textbooks in economics and business management, most of them from American publishing companies.

3. Factors behind the evolving process of internationalization

The rapid development of the internationalization of scientific research in China can be attributed to several factors. First, reform and opening-up policy offers a supporting environment for the expansion of the internationalization. Second, international exchange in persons helped to promote the diffusion of advanced knowledge from developed countries to China. Finally, the development of information technology and its rapid diffusion in China greatly facilitate the diffusion of knowledge in China.

Beginning in the early reform period, Chinese government gradually relaxed restrictions

on the academic exchange with western countries. The academic institutions were given autonomy in establishing contacts with foreign academic institutions. The government also accepted funding from western governments as well as private foundations for the purpose of supporting academic exchange. The restrictions on the publication of western academic books were basically eliminated. While the opening-up policy directly promoted internationalization, economic reform and accompanying development of marketization also directly and indirectly promoted the international exchange in knowledge and in persons. The large-scale introduction of western economics and business textbooks in recent period of time, in fact, has been more or less pushed by commercial motives, because the market became large by the second half of the 1990s. By 2003, only registered economics and business university students numbered nearly one million. This explanation also applied to the rapid rise of the number of students self-paying for studying abroad. Now, in major big and wealthy cities, there are altogether hundreds of agencies to provide service for satisfying such increasing demand. These agencies played an important role in the rapid increase of self-paying high-school students going abroad to study for higher degree.

The increasing international exchange greatly helped to promote the diffusion of the international practices and latest knowledge and technology. One prominent example is that almost all translators of internationally popular monographs and textbooks are those who study abroad for advanced degree or being visiting scholars.

In the late-1970s when China began to introduce the policy of reform and opening to the outside world, the application of information technology (personal computer, network, etc.) in scientific research and higher education was quite rare. The take-off took place in the 1990s. Within 10 years, many important transitions have completed. First, in the beginning of the 1990s, few researchers, university teachers and students have personal computers. Now, personal computers become popularized among them. Second, the application of internet also becomes popularized in universities and research institutes. Now researchers, teachers and students can access English literature sources through websites. In the past, due to the limitation of financial resources, even top research institutes and universities faced difficulties of obtaining sufficient English literature. Now, with the help of websites, they can simultaneously access latest English literature.

4. Some reflections

In the past two decades, China's research and higher education has witnessed significant progress in the direction of internationalization. It is appropriate at this point of time, to put this change in broad perspectives, and to make an assessment of the future development. We begin from the nature of the internationalization.

The nature of the internationalization While the internationalization in the field of basic research and higher education shares many important features with the broader globalization in the conventional economic field, it has some distinctive characteristics. Unlike commodity trade, which is essentially a two-way exchange, based on the comparative advantage, here, less-developed countries import ideas, conventions, etc. from the West, mainly from the U.S., and export nothing. That is, it is a one-way exchange. This basically also applies to the developed part of East Asia: Japan, South Korea, Taiwan, Hong Kong, and Singapore. The internationalization, in many important aspects, become the Americanization: to completely follow standards set in America: In the field of economics, it is just too apparent. The internationalization means following and adopting American standards in almost all economics fields, as set in journal articles, and explained in popular textbooks. While East Asia can export manufactured goods and engineering technology to the West, in the field of basic research and higher education, the thing remains unchanged. That is, East Asia still relies on the West (mainly U.S.) to provide main sources of new basic knowledge, and in the field of higher education still significantly lag behind America.

Historical background and prospect of future development While the present internationalization is associated with some new developments (globalization, the development and broad application of information technology, etc.), this phenomenon itself is not new to China. In fact, the first wave of introducing western sciences and standards on a large-scale took place in the 1920s and 1930s. The tradition still remains. This can be seen from the fact that two most prestigious universities - Beijing University and Qinghua University also were the early pioneers in setting international standards for Chinese universities. In this sense the present wave of internationalization represents a restoration of the historical trend. However, several important differences deserve notice. First, in the 1920s to the 1930s, the sources of imports were diversified. Major source countries include Britain, France, Germany, America, and Japan. Besides Japan at that time played a unique role of an authoritative interpreter of the western systems and values. Now America becomes the single most important source of the "internationalization". Japan no longer plays the role of an authoritative interpreter of the western systems and values. At the same time English becomes the dominant foreign language. Second, in the first wave of the internationalization, a small group of outstanding scholars, who got master/doctor degrees from prestigious western as well as Japanese universities, played a major role, acting as academic entrepreneurs, and laid on the foundation of modern sciences and higher education in China. The present wave of internationalization is much more like a spontaneous and heterogeneous process, and much more intertwined with the marketization, more or less pushed by the commercial motives.

The development of internationalization in the field of research in China closely followed

the footsteps of reform and opening-up in the economic growth and development. So long as the momentum of reform and development remain strong in the future, we have no reason to expect that the past positive trend of internationalization will weaken. We expect that in the coming decade, new progress will be made in the following two fields: first, reform in systems of scientific research and higher education, which will directly and indirectly further promote internationalization; second, significant expansion of academic exchange and cooperation with Asian countries, in particular, in parallel with the development of overall economic integration in East Asia.

Internationalization in the regional context As we noticed before, the internationalization in the field of basic research and higher education is, to large extent, a one-way exchange. It is naturally to ask whether it will be beneficial for East Asian countries/regions to develop "internationalization" in the regional context. This can follow the similar lines advocated by economists in the setting of the economic integration of Northeast Asia, and will include reduction of barriers to academic exchange, expansion of cooperation in scientific research, exploration and establishment of common standards among countries/regions in East Asia. In the past one-half century, East Asia have created a famous "East Asian miracle". However, this miracle is largely economic in nature, and to large extent, based on technology imports and imitation, instead of innovation. Here, I'd like to say a few words about the Japanese comparative experience in the development in industry and in academic field (basic research and higher education). The development in both fields started by large-scale imports from the West. However, subsequent development paths have been quite different. In industry, the initial import substitution was followed by subsequent export expansion to developed countries, first in light industries (in the pre-second world war period), then in heavy industries (in the postwar period). However, similar development has not been repeated in the academic field (basic research as well as higher education). Language per se cannot provide a full explanation. The nature of ideas and systems can offer another reason. To be able to export goods, under certain conditions, is a must for economic catching-up, and this can be realized through ideas and systems imports. However, to be able to export ideas is not necessary for the economic catching-up, and it might not be possible either should idea production follow a self-sustained concentration mechanism. I stress this issue because the so-called internationalization in the common sense of free movement can have radically different implications - it can be only a repetition of the cycle of import-import substitution-import, or it can represent a two-way exchange, just like commodity trade. It is conceivable that the "internationalization" in the regional context will help increase competition in the field of scientific research and higher education, and promote innovation. Obviously, this regional "internationalization" is not inward-oriented and therefore, will not have negative impact on the internationalization in broader context; on the other hand, it may help countries in this region to participate in the

internationalization on the global scale in a more constructive way, and play more innovative role.

5. Conclusions

(1) China has made important progress in internationalization in basic research as well as in higher education. The pace of diffusion of international standards has significantly accelerated since the early 1990s.

(2) In the present wave of internationalization, English-speaking countries, mainly, U.S., played a dominant role.

(3) Reform and opening-up policy in economic area played a positive role in promoting the internationalization in academic filed; besides, information revolution also greatly facilitated this process.

(4) While the general direction of internationalization is right, the possible consequences, in particular, loss of social as well as cultural diversity, deserve serious consideration, and there should exist rooms for positive and constructive government intervention, in line with partnership with the private sector.

(5) Finally, for East Asian countries/regions, to actively promote an outward-oriented regional cooperation in basic research as well as in higher education should be able to help them better participate in the process of internationalization on a global scale, and to make their own unique contributions.

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